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11:00 - 12:30

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Summer 2010 Exam I[st] Chemistry

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[redacted]

Thanks

1. Which one of the these ions is polyatomic ion?

1. Al^{3+} 2. CN^- 3. Ga^{3+} 4. Ca^{2+} 5. Sn^{2+}

2. Which of the following is not a chemical change?

1. iron rusting
2. leaves changing color in the fall
3. liquid water evaporating
4. beef cooking
5. burning a candle

3. Which element listed below is a member of the alkaline earth metal family?

1. B 2. Ca 3. K 4. S 5. none of these

4. Three problems are worked below. Choose the answer that properly describes the correct use of significant digits.

(a) 0.34 + 14.2 = 14.54 (14.5)

(b) 14.3 × 2.0 = 28.6 (29)

(c) 14.21 × 134 = 1.90×10^3 (1.90×10^3)

1. a and b are correct, c is incorrect
2. a and c are correct, b is incorrect
3. b and c are correct, a is incorrect
4. only c is correct
5. none of these

5. Express a mass of 1.250 mL in L.

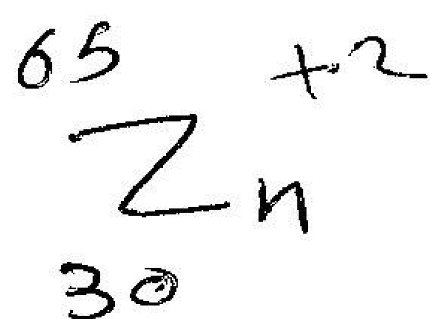
1 L = 1000 mL
x = 1.25 mL

1) 125.0 L 2) 1.250×10^{-5} L 3) 1.250×10^{-3} L 4) 1.250×10^{-2} L 5) 0.0100 L

6. The nucleus of an atom contains

1. only neutrons 2. only protons 3. neutrons and protons
4. neutrons and electrons 5. electrons, protons, and neutrons

1 m = 1000 L



7. The symbol for the species that contains 30 protons, 35 neutrons, and 28 electrons is:

1. $^{65}Zn^{2-}$ 2. $^{35}Zn^{2+}$ 3. $^{63}Zn^{2-}$ 4. $^{65}Zn^{2+}$ 5. none of these

8. A new element is prepared that has two isotopes. One isotope is 22.00% abundant and has a mass of 103.2 u. The other has a mass of 105.2 u. What is the atomic mass of this element?

1. 103.8 2. 104.8 3. 104.2 4. 104.0 5. none of these

9. How many carbon atoms are in a molecule that has an empirical formula of CH_3 and a molecular mass of 45u?

1. 1 2. 2 3. 3 4. 4 5. none of these

10. The correct formula of the ionic compound made from magnesium and chlorine is:

1. MgCl 2. Mg_2Cl 3. $MgCl_2$ 4. Mg_2Cl_2 5. none of these

11. The formula mass of ammonium carbonate is

1. 83.0 u 2. 96.0 u 3. 138 u 4. 152 u 5. none of these

12. The formula of chromium (II) nitride is:

1. CrN_3 2. $Cr(NO_3)_2$ 3. Cr_3N 4. Cr_3N_2 5. Cr_3NO_3

13. Name the compound C_3O_2.

1. carbon oxide

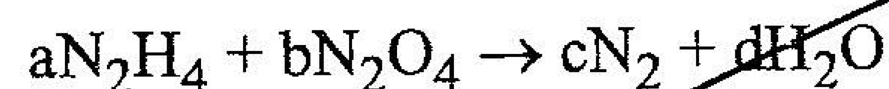
2. carbon dioxide

3. tricarbon dioxide

4. dicarbon trioxide

5. carbon oxalate

14. What is the ratio of a/b for the equation below where a, b, c, and d represent the coefficients in the balanced equation?

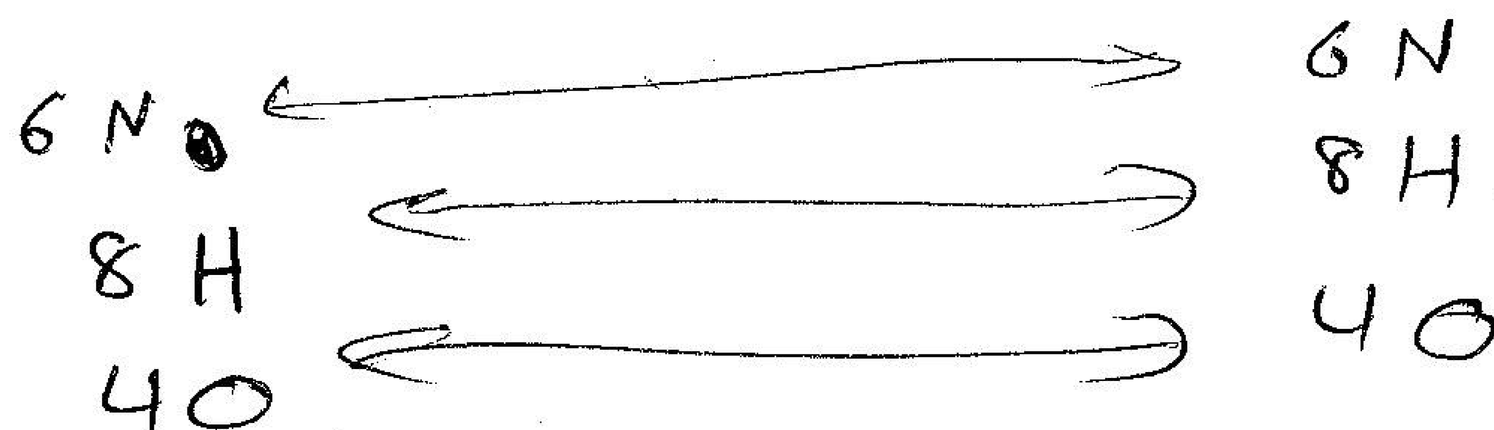


$aN_2H_4 + bN_2O_4 \rightarrow cN_2 + dH_2O$

1. 2/1 2. 1/2 3. 3/1 4. 3/2 5. none of these

a = 2 b = 1 c = 3 d = 4





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15. When reactants of a chemical reaction are mixed in amounts that are NOT equal to the mass or mole ratios found in the balanced equation, the reactant that determines the actual amount of product produced in the reaction is called the

1. Percent yield.
2. limiting reagent
3. Active component.
4. Actual yield.
5. Empirical formula.

16. Cathode-ray-tube experiments provided the first evidence for _______________.

1. subatomic particles
2. x-rays
3. fluorescence
4. electric fields
5. magnetic fields

17. Which element has the electron configuration $[Ar]3d^7 4s^2$?

1. Cu
2. Rh
3. Ti
4. Br
5. Co.

18. Which of the following orbitals might have an m_l equal to +2?

1. s
2. s and p
3. p and d
4. s and f
5. d and f

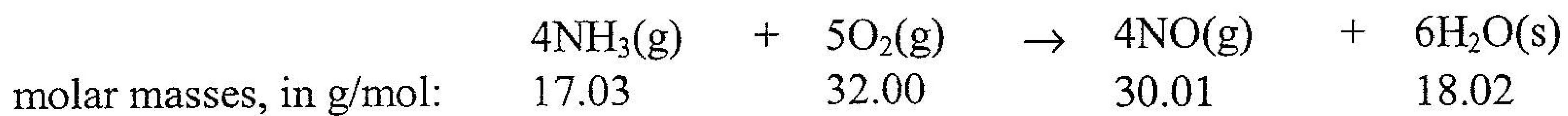
19. How many significant figures should be given in the result of $\dfrac{534.71\times321.83\times0.0019}{7.529\times10^{-3}}$?

1. 2
2. 3
3. 1
4. 4
5. 5

20. Arrange in order of increasing ionization energy:
As, F, N   smallest ----- ----- ----- largest

1. As_ _N_ _F
2. F_ _N_ _As
3. N_ _As_ _F
4. As_ _F_ _N
5. none

Q2: (5 points) One of the steps in the commercial process for converting ammonia to nitric acid involves the conversion of NH_3 to NO:



	$4NH_3(g)$	+	$5O_2(g)$	$\rightarrow$	$4NO(g)$	+	$6H_2O(s)$
molar masses, in g/mol:	17.03		32.00		30.01		18.02

a) If 1.00 g of NH_3 and 1.50 g of O_2 are mixed, which is the **limiting reactant**?

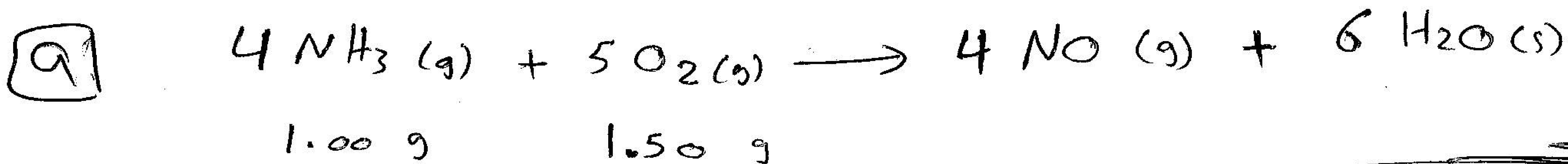
b) What is the **theoretical yield** (in grams) of NO that can be produced when the quantities in part a are mixed?

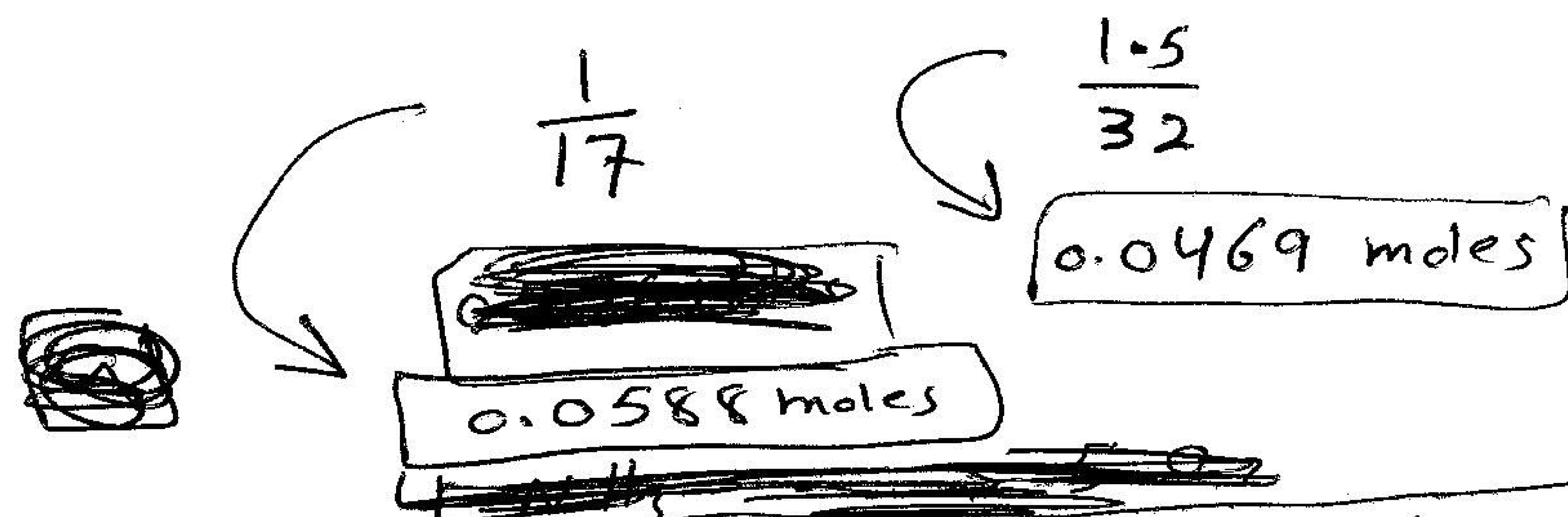
c) If 1.05 g of NO are actually obtained from the reaction, what is the **percent yield**?

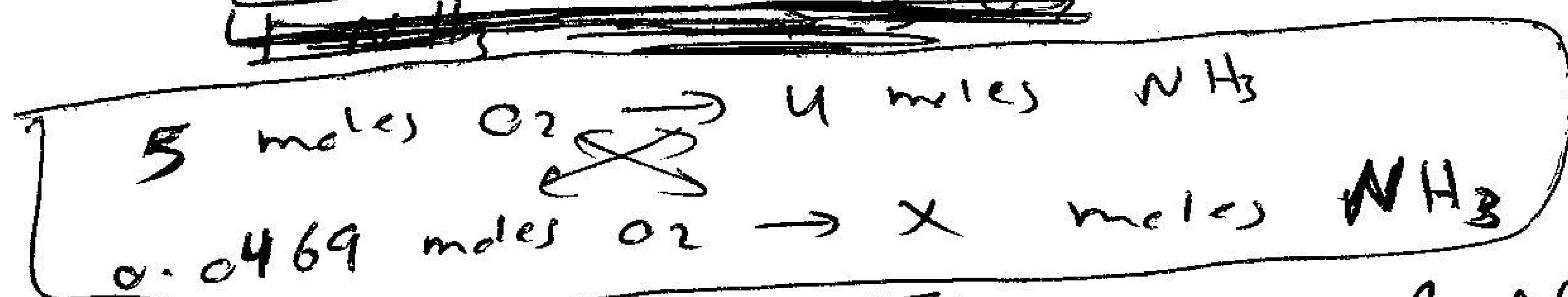
End of Questions

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a





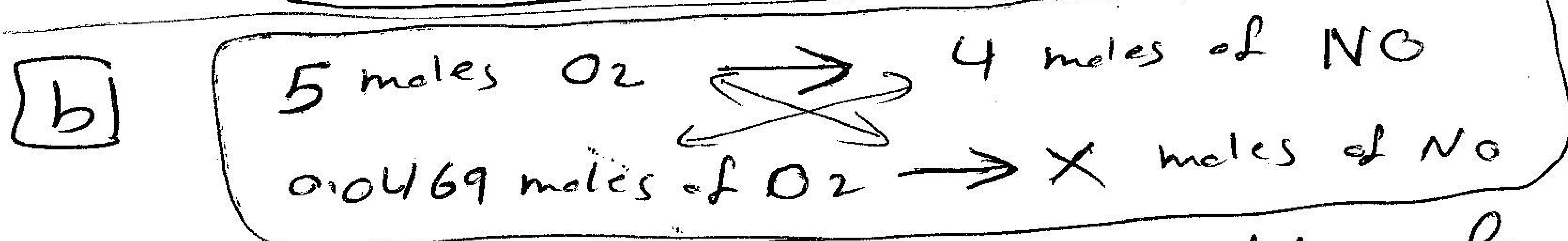


for this reaction

∴ we need 0.0375 moles of NH_3

excess is NH_3 ⟹ ∴ O_2 is the limiting Reactant

b



we produce 0.0375 moles of NO from this reaction

we produce (0.0375)(30) = 1.125 grams of NO

c

Percent Yield = $\frac{\text{actual}}{\text{theoritical}} \times 100\%$ = ~~1.05 / 1.125~~ 93%

$= \frac{1.05}{1.125} \times 100\% \approx 93\%$

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PERIODIC TABLE OF THE ELEMENTS

http://www.ktf-split.hr/periodni/en/

Key: GROUP NUMBERS IUPAC RECOMMENDATION (1985): 13 — GROUP NUMBERS CHEMICAL ABSTRACT SERVICE (1986): IIIA — ATOMIC NUMBER: 5 — RELATIVE ATOMIC MASS (1): 10.811 — SYMBOL: B — ELEMENT NAME: BORON

PERIOD	1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIIIB	9 VIIIB	10 VIIIB	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	1 1.0079 H HYDROGEN																	2 4.0026 He HELIUM
2	3 6.941 Li LITHIUM	4 9.0122 Be BERYLLIUM											5 10.811 B BORON	6 12.011 C CARBON	7 14.007 N NITROGEN	8 15.999 O OXYGEN	9 18.998 F FLUORINE	10 20.180 Ne NEON
3	11 22.990 Na SODIUM	12 24.305 Mg MAGNESIUM											13 26.982 Al ALUMINIUM	14 28.086 Si SILICON	15 30.974 P PHOSPHORUS	16 32.065 S SULPHUR	17 35.453 Cl CHLORINE	18 39.948 Ar ARGON
4	19 39.098 K POTASSIUM	20 40.078 Ca CALCIUM	21 44.956 Sc SCANDIUM	22 47.867 Ti TITANIUM	23 50.942 V VANADIUM	24 51.996 Cr CHROMIUM	25 54.938 Mn MANGANESE	26 55.845 Fe IRON	27 58.933 Co COBALT	28 58.693 Ni NICKEL	29 63.546 Cu COPPER	30 65.39 Zn ZINC	31 69.723 Ga GALLIUM	32 72.64 Ge GERMANIUM	33 74.922 As ARSENIC	34 78.96 Se SELENIUM	35 79.904 Br BROMINE	36 83.80 Kr KRYPTON
5	37 85.468 Rb RUBIDIUM	38 87.62 Sr STRONTIUM	39 88.906 Y YTTRIUM	40 91.224 Zr ZIRCONIUM	41 92.906 Nb NIOBIUM	42 95.94 Mo MOLYBDENUM	43 (98) Tc TECHNETIUM	44 101.07 Ru RUTHENIUM	45 102.91 Rh RHODIUM	46 106.42 Pd PALLADIUM	47 107.87 Ag SILVER	48 112.41 Cd CADMIUM	49 114.82 In INDIUM	50 118.71 Sn TIN	51 121.76 Sb ANTIMONY	52 127.60 Te TELLURIUM	53 126.90 I IODINE	54 131.29 Xe XENON
6	55 132.91 Cs CAESIUM	56 137.33 Ba BARIUM	57-71 La-Lu Lanthanide	72 178.49 Hf HAFNIUM	73 180.95 Ta TANTALUM	74 183.84 W TUNGSTEN	75 186.21 Re RHENIUM	76 190.23 Os OSMIUM	77 192.22 Ir IRIDIUM	78 195.08 Pt PLATINUM	79 196.97 Au GOLD	80 200.59 Hg MERCURY	81 204.38 Tl THALLIUM	82 207.2 Pb LEAD	83 208.98 Bi BISMUTH	84 (209) Po POLONIUM	85 (210) At ASTATINE	86 (222) Rn RADON
7	87 (223) Fr FRANCIUM	88 (226) Ra RADIUM	89-103 Ac-Lr Actinide	104 (261) Rf RUTHERFORDIUM	105 (262) Db DUBNIUM	106 (266) Sg SEABORGIUM	107 (264) Bh BOHRIUM	108 (277) Hs HASSIUM	109 (268) Mt MEITNERIUM	110 (281) Uun UNUNNILIUM	111 (272) Uuu UNUNUNIUM	112 (285) Uub UNUNBIUM		114 (289) Uuq UNUNQUADIUM				

LANTHANIDE

6	57 138.91 La LANTHANUM	58 140.12 Ce CERIUM	59 140.91 Pr PRASEODYMIUM	60 144.24 Nd NEODYMIUM	61 (145) Pm PROMETHIUM	62 150.36 Sm SAMARIUM	63 151.96 Eu EUROPIUM	64 157.25 Gd GADOLINIUM	65 158.93 Tb TERBIUM	66 162.50 Dy DYSPROSIUM	67 164.93 Ho HOLMIUM	68 167.26 Er ERBIUM	69 168.93 Tm THULIUM	70 173.04 Yb YTTERBIUM	71 174.97 Lu LUTETIUM

ACTINIDE

7	89 (227) Ac ACTINIUM	90 232.04 Th THORIUM	91 231.04 Pa PROTACTINIUM	92 238.03 U URANIUM	93 (237) Np NEPTUNIUM	94 (244) Pu PLUTONIUM	95 (243) Am AMERICIUM	96 (247) Cm CURIUM	97 (247) Bk BERKELIUM	98 (251) Cf CALIFORNIUM	99 (252) Es EINSTEINIUM	100 (257) Fm FERMIUM	101 (258) Md MENDELEVIUM	102 (259) No NOBELIUM	103 (262) Lr LAWRENCIUM

(1) Pure Appl. Chem., 73, No. 4, 667-683 (2001)
Relative atomic mass is shown with five significant figures. For elements have no stable nuclides, the value enclosed in brackets indicates the mass number of the longest-lived isotope of the element.
However three such elements (Th, Pa, and U) do have a characteristic terrestrial isotopic composition, and for these an atomic weight is tabulated.

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